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PATENT AND TECHNICAL TRANSLATION

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DECLARATION

The undersigned, Olaf Bexhoeft, hereby states that he is well acquainted with both the English and German languages and that the attached is a true translation to the best of his knowledge and ability of the German text of PCT/EP2005/050182, filed 01/18/2005, and published on 08/25/2005 under No. WO 2005/077797 A2, and of thirty-six (36) amended claims.

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.

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Specification

Method for Storing Rolls of Material

The invention relates to methods for storing rolls of material in accordance with claims 1 or 10.

A device for supplying an installation, in particular a printing press, with material is known from DE 39 10 444 C2, wherein rolls are placed into intermediate storage in a buffer depot. The depot has two shelf blocks, between which a stacking device is provided, which is designed for serving both shelf blocks .

DE 100 57 735 A1 discloses a system for providing articles, having a plurality of parallel rows of shelves, wherein storage and pickup lanes are alternatingly located between the rows of shelves.

A storage system is disclosed in DE 21 58 537 A, wherein storage locations of a center row of shelves can be served from aisles adjoining both sides.

A system for storing and making available material to be processed in a production line is known from DE 37 38 052 A1, wherein the shelves have been divided into readiness and storage areas and the storage of the material and its removal from the storage area or transferring to the readiness area, or into other lanes of shelves takes place with the guidance of a computer.

The object of the invention is based on creating methods for the storage of prepared and unprepared rolls of material in a manner in which the storage space is optimized.

In accordance with the invention, this object is attained by means of the characteristics of claims 1 or 10.

The advantages to be gained by means of the invention lie in particular in that by means of the depot a large degree of flexibility and supply, even during peak demands, is assured. The storage space which has to be reserved is optimized.

A concept of several shelf blocks, which overlap at least in sections in the longitudinal direction, makes possible the delivery of not yet prepared rolls independently of the production process, as well as the rapid forwarding of prepared rolls to a shelf block located closer to the printing press.

The embodiment of a shelf block located on the inside for being accessible from both longitudinal sides makes possible a very efficient redepositioning of the rolls between individual blocks. The storage and removal of a roll from an inside located shelf block is not tied to a serving device of an aisle, so that supplying of the shelf block can take place from one side, while a removal from the other side can take place simultaneously. Travel around the shelf block, and therefore the mutual interference of serving devices with each other, can be avoided.

Exemplary embodiments of the invention are represented in the drawings and will be described in greater detail in what follows.

Shown are in:

Fig. 1, a schematic representation of a print shop with a printing press and a roll supply system,

Fig. 2, a view from above on the device for material supply in a printing press installation,

Fig. 3, a front view of the device for material supply in Fig. 2,

Fig. 4, a flow chart of the method for storage,

Fig. 5, a sub-process for determining the storage strategy,

Fig. 6, a sub-process for determining the redepositioning strategy.

An installation using and/or processing webs, for example a print shop in accordance with Fig. 1, has for example at least one machine 01 using and/or processing webs, for example a printing press 01, a material supply system 02, for example a roll supply system 02, as well as a product planning system 03, if desired. It moreover has, for example, a control system 05 embodied as a material flow system 05 for coordinating and assuring the supply of the production with rolls. Information regarding the set-up of the machine and/or the requirement for rolls for a defined planned production are available to the product planning system, or even a production plan extending farther into the future, from which the future roll requirements (paper type, amounts, dimensions) can be derived.

The printing press 01 has at least one unit 04, embodied as a printing unit 04 and/or printing tower 04, for imprinting a web, and is supplied with material, for example paper, by at least one unit 06 embodied as a roll changer 06 (roll changer for operating when the press is stopped or roll changer for changing rolls at full press speed). The printing press can furthermore contain a unit 07, arranged downstream of the printing unit 04, for processing the imprinted web, for example at least one folding apparatus 07. The at least one printing unit 04, the at least one roll changer 06 and possibly also the at least one folding apparatus 07, are connected, for example via at least one signal line 09, for example an internal network 09 of the printing press,

with at least one operating and computing unit 08, for example a control console with a PC.

As a rule, several (for example five or even more) roll changers 06 are combined on a folding apparatus 07 for running a production. This combination with the associated printing units 04, or printing towers 04, is called a section A, B. A printing press line consists of several sections A, B, for example, on which respectively different productions can be run.

In the example represented in Fig. 1, the printing press 01 has two sections A, B by way of example, each with two printing towers 04, three roll changers 06, three operating and computing units 08, as well as with a folding apparatus 07 per section A, B. In the embodiment in accordance with Fig. 1, the roll changers 06, as well as the printing units 04 of each section, are connected via the network 09, for example. Via the network 09 there is a connection (homogeneous or heterogeneous) between the sections A, B and/or the operating and computing units 08. The folding apparatus 07, if provided, are also in connection with this network 09, for example.

The operating and computing units 08, together with their transverse connection, as well as possibly provided, but not represented further computing and data processing units, form a so-called management level 11, or press management level 11 of the printing press 01. The latter is, for example, in a signal connection 12 with, for example, a computing and/or data processing unit 13 of the production planning system 03. Production-relevant data, for example, are transferred via this signal connection 12 from the product planning system 03 to the printing press 01.

In one embodiment, the printing press 01 is, for example, in a suitable way, in a signal connection 15, 16, for example via the material flow system 05, with the roll supply system 02. Production-relevant data can be transferred at least via the signal connection 16 from the printing press 01 to the material flow system 05, for example to a logic device implemented there for the (partial) performance of one or several of the processes explained in Fig. 4. To this end, the material flow system 05 has at least one computing and/or data processing unit 17, in which the implemented logic device is housed.

In addition or alternatively to the signal connection 16, a transfer can also take place via an optional signal connection 20 from the product planning system 03. If provided, the material flow system 05 can in principle also be assigned to the roll supply system 02 or the printing press 01 or, in an advantageous embodiment, within the scope of its tasks, can be of a higher order than these two.

A possible configuration by means of hardware technology of a roll supply system 02 is schematically represented in Fig. 2, however, in it not all subsystems described in what follows need not be present in a device in accordance with the invention and/or for the method in accordance with the invention, and the individual functional subsystems can be embodied in a manner different from that represented.

In the exemplary embodiment in accordance with Fig. 2, the roll supply system 02 has, for example, at least one stock reception arrangement 18, a first transport system 19, as well as at least one depot 21, as subsystems.

In the longitudinal direction, the depot 21 has at least three side-by-side shelf blocks 22, 23, 24, which partially

overlap at least in the longitudinal direction, consisting of an outer shelf block 22 located remote from the roll changers 06, and a shelf block 23 next to the roll changers 06, and an inner shelf block 24 located between the shelf blocks 22 and 23. In this case, an arrangement of adjoining, in particular aligned, storage spaces 26, 27, 28 (in Fig. 2 only one storage space 26, 27, 28 is identified per shelf block 22, 23, 24) is understood to be a shelf block 22, 23, 24, each of which can receive one roll, either side-by-side or one above the other.

The center shelf block 24 is embodied in such a way that in at least one area a storage space 28 assigned to it can be served from both longitudinal sides of the shelf block 24. To this end, in an advantageous embodiment the shelf block 24 has only one storage space 24 over its width in this area.

If several storage spaces should be provided over the width, care must be taken that only one of the storage spaces arranged one behind the other is located in the area provided (for the purpose intended here) and that a serving device has the appropriate reach for moving a roll over an empty storage space.

Free spaces, for example corridors, extending in the longitudinal direction between respectively two shelf blocks 22, 23, 24, are provided, to each one of which at least one transport system 29, 30, for example a shelf serving element 29, 30, is assigned. The shelf serving elements 29, 30 arranged between two shelf blocks 22, 23, 24 are preferably designed so that they can reach storage spaces 26, 27, 28 of both adjoining blocks 22, 23, 24. The shelf serving elements 29, 30 are preferably designed in such a way that a tool, working together with the rolls, has at least one degree of freedom in the horizontal direction along the

corridor, in the vertical direction and in the horizontal direction transversely in respect to the corridor.

The transport system 19 has at least one transport track 31 from the delivery point to the depot 21. In particular, at least one transport track 31 to a storage space 32 of the outer shelf block 22 is provided, which is used, for example, as a transfer station 32 in the course of storing, or is designed in that way.

In a preferred embodiment the transport system 19 additionally has at least one transport track 33 to a storage space 34, for example as the transfer station 34, of the shelf block 24 located on the inside. For this purpose the outer shelf block 24 has an access, for example a passage, or the outer shelf block 24 does not extend over the same length of the inner shelf block 24, such as is the case in the exemplary embodiment in accordance with Fig. 2. Rolls coming from the stock reception arrangement, for example not yet prepared rolls, therefore can be stored either in the outer shelf block 22 or in the inner shelf block 24.

In an advantageous embodiment the transport system 19 has in addition at least one transport track 36 over a so-called preparation circuit 35, which leads from the stock reception arrangement 18, for example via an unpacking station 37 and/or a glue preparation station 38, to a storage space 39, for example in the form of a transfer station 39, of the inner shelf block 24. For this purpose the above mentioned passage, or a shortening of the outer shelf block 22, is for example provided.

In a further development, the transport tracks 31, 33 and/or 36 are connected with each other in such a way that a roll which had already been prepared in the unpacking station 37 and/or

the glue preparation station 38 can be moved to the storage space 32 of the outer shelf block 22.

In an advantageous further development, the transport system 19 has a transport track 41, which is different from at least the transport track 32, on which rolls from a storage space 42, for example in the form of a transfer station 42 of the outer shelf block 22, can again be placed on the transport tracks 31, 33, 36 of the transport system 19. In this way a stored unprepared roll can be taken out again and, prepared via the transport track 36, passed to the inner shelf block 24.

In the same way, in an advantageous further development the transport system 19 has a transport track 43, which is different from at least the transport track 33 or 36, on which rolls from a storage space 44, for example in the form of a transfer station 44, of the inner shelf block 24 can again be placed on the transport tracks 31, 33, 36 of the transport system 19. In this way an unprepared roll stored in the inner shelf block 24, can be taken out again and, prepared via the transport track 36, passed back to the inner shelf block 24.

Now the serving element 29 arranged between the outer shelf block 22 and the inner shelf block 24 takes over the roll delivered to the storage space 32 and redeposits it, for example, on a free storage space 26 of the outer shelf block 22. As a rule, the outer shelf block 22 has only unprepared rolls. However, in exceptional situations it can also be used as a buffer for already prepared rolls. This can be the case, for example, if a long production pause has been used for the preparation and/or a large production is planned.

If there are certain logistic reasons, of if the outer shelf block 22 is already fully stocked with unprepared rolls, the

serving element 29 takes up the delivered, for example unprepared roll and deposits it on a storage space 28 of the inner shelf block 24. In this case the inner shelf block 24 is used as a buffer for unprepared rolls. Thereafter, for the purpose of preparing them, these can be taken by the serving element 29 from the storage space 28, again via the storage space 42 of the outer shelf block 22, to the transport track 19, and thus to the unpacking station 38 and/or the glue preparation station 38.

The serving element 30 arranged between the inner shelf block 24 and the outer shelf block 23 next to the roll changer 06 is also embodied for serving both adjoining shelf blocks 23, 24. For example, it now takes over an already prepared roll delivered to the storage space 39 and redeposits it, for example, on a free storage space 28 of the inner shelf block 24. In accordance with the above explanations, the inner shelf block 24 can contain prepared, as well as unprepared rolls. However, it can also only contain prepared rolls, for example, if a large production is planned. In exceptional cases only unprepared rolls can be stored if, for example, an extended production pause is imminent and/or a respectively large delivery has taken place.

It is now possible by means of the serving element 30 to redeposition unprepared rolls from the storage space 34, for example on a free storage space 28 of the inner shelf block 24, or on a free storage space 27 of the shelf block 23 which is closest to the roll changer 06.

If certain logistic reasons exist, in exceptional cases it is possible by means of the serving element 30 to store unprepared rolls from the inner shelf block 24, for example from the storage space 34 or a storage space 28, in the shelf block 22 nearest to the roll changer 06, for buffering.

However, basically the inner shelf block 24 is used for buffering with prepared and unprepared rolls, so that preferably only unprepared rolls are stored in the outer shelf block 22 located remote from the roll changer 06, and prepared rolls only in the shelf block 23 close to the roll changer 06. Together with parts of the inner storage block 24, the outer storage block 22 functions as a main depot, and the shelf block 23 close to the roll changer 06, together with parts of the inner shelf block 24, as a so-called day storage.

A further transport system 46 is provided between the outer shelf block 28 and the roll changers 06, by means of which rolls can be removed from the shelf block 23 and taken to the, or one of the roll changers 06. The transport system can basically be embodied in any desired way, for example with fork lifts, with "driverless transport systems (FTS), track-bound vehicles or those with tires, manned or unmanned. However, it is advantageous if it is designed without drivers and receives its tasks from a higher-order guide and/or control system, for example from the material flow system 05, or an assigned roll changer 06.

In the example, an inner supply circuit 47 embodied as a track-bound transport system 47, for example driven track-bound transport carts with appropriate guide devices, is assigned to each roll changer 06. Storage spaces 48 used for transfer or deposit, for example storage spaces 48, are assigned to this transport system 47 in the shelf block 23.

In the mentioned embodiment with a defined storage space 48 per roll changer 06, the rolls needed or ordered by the respective roll changer 06 are supplied by the serving element 30. These can be taken from the storage spaces 27 in the shelf block 23 or the storage spaces 28 of the inner shelf block 24. In special cases

the serving element 30 can take a roll directly from the transfer space 39 and place it in the storage space 48.

In an embodiment not represented, the removal of the required roll can also take place by means of a transport system 46, wherein the transport then is performed, for example, by transport means (for example a manned fork lift or FTS) which are not assigned to a single roll changer 06. In this case it might not be necessary to define fixed storage spaces 48 for the individual roll changers 06. In such a transport system a transport means can supply itself upon demand from one of the different storage spaces 48 intended for the deposit, for example. If in a further development all or some of the storage spaces 27 should be accessible from both sides, the rolls meeting the requirements can be directly taken from the shelf block 23 by the transport means.

The serving elements 29, 30 are preferably designed as shelf serving elements 29, 30, as represented in Fig. 3. A gripping and/or lifting mechanism 51 is arranged on a vertically extending mast or support 52 and driven in such a way that it can be moved in the vertical direction from a storage space of a lowermost level E1 of the respective shelf block 22, 23, 24 to a storage space on an uppermost level E11. The support 52 is seated in the lower area and the upper area of the depot 21 and driven in such a way that it is horizontally movable in the longitudinal direction of the corridors. The gripping and/or lifting mechanism 51 in turn can be moved in respect to the support 52 by rotation and/or a linear movement in the horizontal direction and driven in such a way that it can pick up rolls from the two adjoining shelf blocks 22, 23, 24, or can deposit rolls there. It can be further seen in Fig. 3 that the inner shelf block 24 only includes a

single storage space 28, 34, 39, 44 over its width, which is accessible to the respective serving element 29, 30 from both sides of the shelf block 24.

In the course of selecting a roll or the storage space 27 or 28 by the serving element 30 and the following deposit at the storage space 48, demands made on geometry and/or quality of the desired roll are taken into consideration. This also applies to the example not shown with the direct access to the storage spaces 27 by an alternative transport system 46.

It is advantageous to provide at least one depot management system for this purpose, i.e. the exact knowledge of the actual occupation of the storage spaces 26, 27, 28, 32, 34, 39, 48, together with the specific properties of the rolls, in which the storage spaces 26, 27, 28, 32, 34, 39, 48 of the rolls with the appropriate properties are memorized. In an advantageous embodiment, specific roll data are collected in the area of the stock reception arrangement (or possibly in the area of the roll preparation) and assigned to the respective roll. Then the depot management system has information at all times regarding the storage of specific rolls in the depot 21.

In a particularly advantageous embodiment, the depot 21 (with the depot management system), the stock reception arrangement 18 and at least the outside transport systems 19, 45, i.e. those located outside the depot 21, are integrated into a material flow system 05, which is connected with the management level 11 and/or the production planning system 03. If the serving elements 29, 30 are not directed by a depot management system, the function of depot management and dissemination of orders to the serving elements 29, 30 can also take place via the material flow system 05, if required.

A particularly effective material management, the optimized storage in the shelf blocks 22, 23, 24 and an efficient transfer to the roll changers are possible by means of the integration into a material flow system 05.

The described material supply system 02, the design of the depot 21, for example together with all or some of the transport tracks 31, 33, 36, 42, 43 mentioned, is of particular advantage in connection with printing presses 01 having several sections A, B. The material supply system 02, or the design of the depot 21, are advantageous in particular when several printing presses 01 are arranged in series in the manner of a printing press installation, such as represented in Fig. 2, for example.

The depot 21 extends over the entire length of the two printing presses 01. Here, the shelf block 23 closest to the roll changers 06 substantially extends over the entire length from the first to the last roll changer 06. In the example, the inner shelf block 24 extends over the same length. In order to make possible direct access from the stock reception arrangement 18 to the inner shelf block 24, the outer shelf block 22, which is closest to the stock reception arrangement 18, is made shorter. It is essentially placed symmetrically in respect to the two printing presses 01 to be supplied. In the example, the material supply system 02 has two areas for the stock reception arrangement 18, which are connected via respective transport systems 19 with storage spaces 32 in the areas near the end of the shelf block 24. Several serving elements 29, 30 are provided in the corridors between respectively two shelf blocks 22, 23, 24.

The design of the depot 21 represented, in particular in connection with the printing press installation, makes possible a particularly flexible supply of the printing presses 01, since not

only is a buffer function achieved by means of the inner shelf block 24, but the supply of a printing press 01 with rolls from an area of the depot 21 can take place, which is located at the level of the other printing press, and vice versa.

In principle it would be possible to provide several inner shelf blocks 24, which then would have only one storage space over their width. A serving element 29, 30 is then respectively arranged between each of two shelf blocks 22, 23, 24.

In the simplest case the stock reception arrangement 18 consists of a transfer position to the automatic roll supply and an input possibility for the roll entry information. However, optionally it is advantageous not to perform the unloading from a truck, train or ship with the fork lift, but to automate it. Here, a differentiation between three basically different models can be made:

a) horizontal transport of the paper rolls and rolling the rolls over the circumference,

b) upright transport of the paper rolls on a truck/railroad car/ship with rails on the bottom,

c) upright transport of the paper rolls on a special truck/railroad car/ship, which have a sort of conveyor belt on the loading area.

A roll separation device can be assigned to the stock reception arrangement 18. As a rule, rolls of half or quarter width are transported upright on top of each other. In this case it is necessary to separate the rolls, i.e. to lift the upper roll and to place it next to the lower, etc.

Accidents can occur in an automatic system if the goods to be transported do not have the expected shape. It is therefore practical to check that the exterior shape is maintained within

certain limits and to additionally assign a contour check to the stock reception arrangement 18. In connection with paper rolls, systems using photoelectric barriers, photoelectric gratings or area scanners are offered, to which a more or less intelligent evaluating device is connected.

It is furthermore of advantage if the delivered roll is identified in the area of the stock reception arrangement 18, for example by a bar code detector, for example a bar code reader 53, or other system. The bar code label is used for identifying the roll and is detected by the system.

For example, for the horizontal storage of prepared or unprepared rolls on several levels E1 to E11, the depot 21 is designed as an upright shelf depot 21. Basically the upright shelf depot 21 can also be capable of receiving pallets or rolls which are stored upright. However, if the rolls are stored upright, for example in the main depot 21, at least the serving elements 29, 30 or the transport system 46 must make tilting of the rolls possible, or a tilting station is arranged between the depot 21 and the roll changer.

As a rule, a preparation circuit 35 has the unpacking station 37 and the glue preparation station 38, which for example is designed as an automatic glue preparation device. Added to this, if desired, are transfer positions in the transport system 19. The unpacking station 37 has means, for example, on which the paper rolls can be aligned and semi-automatically unpacked. Furthermore, at this location the bar code can be picked up for checking, for example with a hand scanner, the diameter can be determined and the roll can be weighed for checking. The glue preparation station 38 represents an automatic glue preparation

system, for example. A suitable glue preparation station 38 can process approximately 15 rolls per hour, for example.

When stocking the depot 21, in particular the shelf block 23 and parts of the shelf block 24 with prepared rolls, it should be noted that the glue preparation possibly is usable only for a limited time, at present 8 to 12 hours, for example, and must then be renewed. In the depot 21 it is possibly also necessary to handle roll remnants on loading aids, which were returned from a roll changer 06, as well as loading aids.

A roll changer 06 has, for example, two pairs of support arms for receiving paper rolls. A section of a transport track is assigned to each roll changer 06, on which a paper roll for the roll changer 06 can be deposited. In this case the roll changer 06 with its buffer position (deposit space) is also called an inner supply circuit 47, for example, and is a part of the printing press 01, or is assigned to it. It is used for rolling off the paper rolls and for automatic roll change with gluing.

For transport over extended horizontal distances, such as between the stock reception arrangement 18 and the depot 21, plate or belt-and-plate conveyors are for example employed, which function in a manner similar to a conveyor belt. For transport over distances between the stock reception arrangement 18 and the depot 21, or the depot 21 and the printing press 01, it is also possible to employ transport systems 19, 46 which, for example, are designed as driverless corridor transport vehicles. However, within the preparation circuits 35 and the inner supply circuits 31, track-bound transport systems 19, 46 are employed, for example driven, track-bound transport carts with appropriate guide devices. In small to medium installations it is possible to

realize the entire roll transport by means of track-bound transport carts.

The movement control of the transport systems 19, 46 is provided in an advantageous further development by means of a control device assigned to these transport systems 19, 46, for example a memory-programmable control device, in particular an SPS configurator (including an operating panel by means of which drive orders can be configured) or, in an advantageous embodiment, by means of a computer unit assigned to these transport systems 19, 46, for example a vehicle guidance computer.

The roll supply system 02 should be capable of providing a printing press 01, or a printing press installation with one or several lines of presses, each of which can consist of several sections A, B, with prepared paper rolls in a sufficient and timely manner. It is furthermore desirable for the roll supply system 02 to be capable of working off roll requests and return orders from roll changers 06. Ideally it is capable of determining the actual paper requirements on the basis of production data provided by the product planning system 03, for example also on the basis of actual press parameters actually provided by the press management level 11. "Nominal" production data, which change in the course of production, should be taken into consideration.

For meeting the mentioned demands, the print shop, together with the depot 21, has the above mentioned material flow system 05 for planning, coordinating and controlling the flow of material in the print shop. In an advantageous embodiment, the material flow system controls and manages the entire flow of material in the installation and is of a higher order than the subsystems (transport system(s) 19, transport system(s) 46, and possibly

further transport and preparation systems) of the roll supply system 02. It includes, for example besides the direct roll supply, the handling of the stock reception arrangement 18 and the management of the depot 21. If the depot 21 is provided with its own depot management system in the form of a subsystem, the material flow system 05 has at least one interface with this subsystem.

The material flow system 05 receives information regarding planned and current production for example via a signal connection from the higher-order product planning system 03 and/or from the printing press 01, in particular the management level 11 of the latter. These data a processed in the material flow system 05, and the individual orders are forwarded to the mentioned subsystems. Movement control, or the working off of the order itself, preferably takes place in the control device assigned to the subsystem (partially autonomous).

Because of its topology and the transport tracks, the described depot 21 is not primarily designed for keeping a multitude of different articles available for rapid access, such as is the case with a consignment depot, or to store large amounts of the same article for successive access (storage device). Instead, it is designed for receiving the planned requirements of materials for a pending production period and to deliver them in the correct way for a production to the press 01 (buffer storage).

The stored material (rolls) can be stored in the delivered state (unprepared) and is prepared in the depot 21 for the production by appropriate devices and methods (preparation circuit 35). The production preparation substantially relates to unpacking and preparation for automatic gluing (see above).

Advantageously the depot 21 is provided with an automatic stock reception arrangement 18, or an automatic storage track (transport tracks 31, 33, 36), by means of which truck loads can be automatically serviced, or on which rolls can be randomly manually placed. In this area the shape of the stored material is checked, defective rolls are removed as required, moreover the rolls are automatically separated by means of a device, if needed, identified by bar code readers 53 and transported to the storage space of the respective storage block 22, 23.

The storage spaces are designed in such a way that paper rolls of a defined minimum diameter can be transported by means of the respective serving elements 29, 30, or by the transport system 19, and can be stored in the storage spaces 26 to 28, 32, 34, 39, 48. In this way handling, making available and managing of loading aids (such as pallets, for example) are avoided.

For paper rolls which fall below the defined minimum diameter, the depot 21 can have loading aids, for example in an area of storage places specially provided for this in the outer shelf block 23, which faces the processing machine.

Ideally the depot 21 is designed and equipped in such a way that rolls of material, which were stored in the delivered state, can be automatically serviced in the unpacking and preparation circuit 35. The unpacking and preparation circuit 35 is a part of the depot 35 and is equipped with fully automatic, semi-automatic or manually operated devices for unpacking (unpacking station 37) and gluing preparation (glue preparation station 38). The operation of the depot 21 is optimized to the effect that manual intervention is minimized to a large extent.

The advantages of the design of the depot 21 are used in particular together with a corresponding method for storage with a

corresponding storage strategy. This method is characterized in that the storage in the depot 21 is already controlled and optimized to the requirements of the pending productions. This is achieved by means of an interface with the product planning system 03, through which the data regarding the pending production are transmitted. This information is processed in the material supply system and the rolls for storage - in particular unprepared rolls - are requested on the basis of these data. This request can be prepared via a list of requirements in paper form, via an indicator display or by means of communications with an upstream located storage area (reservoir) with its own depot management or a rapid delivery by truck.

To find the optimal time period for production preparations, the method (or the logic implemented in the material supply system) takes at least the limited effectiveness of the glue preparation into account, which must be matched to the planned production period. In addition, preferred preparation times can be advantageously taken into account in the logic. These can be windows of time in which no or only little production occurs (in order to achieve a balanced use of the depot vehicles) and/or they can be windows of time during normal daylight working hours in order to avoid bonuses for shift or night work (optimizing the cost).

The method is designed in such a way that the available storage space can be used, optimized in regard to the actual requirements. This means that with rapidly changing productions it is necessary to keep a plurality of different articles (rolls of different dimensions and/or quality) available and redistributed in accordance with production planning in the storage area near the presses (for example shelf block 23) in

order to achieve a large material through-put, In connection with long productions, in particular at night or on the weekend, it is necessary to keep a large amount of identical articles available and to match the production preparation optimally to the process in order to be able to evenly supply the installation during long production periods.

The method can also be advantageously designed to assure the provision of the production installation with material to the greatest extent also in case of incidents (for example the loss of the preparation circuit 35, an unplanned requirement for a type of roll which is not in the depot at the time (pass through), or in case of delivery of a similar article, if the required one is not available). In case of the loss of the higher order material supply system 02, the method provides the option of a configurator operation, for example.

The method is based on parallel or approximately parallel running processes for storage, redepositioning and serving the press 01. Fig. 4 shows this in a rough flow diagram.

In the left branch (storage process), the planned requirements from the production planning system 03 are read in by the logic on which the material management system 02 is based or by the software. Subsequently these data are evaluated in view of an optimal storage strategy. This evaluation is based on the special design of the depot 21, consisting of the two outer and the inner storage blocks, together with the serving elements 29, 30, the preparation circuit 35 and the transport system 19, by means of which unprepared, as well as prepared rolls can be stored and redeposited in the depot 21. Although basically there is a gradient from unprepared rolls to prepared rolls from the stock reception arrangement 18 to the press 01 in the shelf blocks, the

path of an unprepared roll "backwards" from the inner shelf block 24 to the outer shelf block 25 remote from the press 01 or to the preparation circuit 35 is also possible (in contrast to conventional systems). The determination of the storage strategy is represented somewhat more specifically in Fig. 5.

In the sub-process for determining the storage strategy ("determination of the optimal storage strategy" from Fig. 4) the requirements for paper rolls or rolls of material are first determined, and an alignment with the existing inventory is made. Depending on the result, in case of a deficit the requirement for the storage of fresh rolls (from trucks, railroad cars or a storage facility) in the depot 21 is determined.

Parallel with this, the expected occupation of the depot is determined as further criteria affecting the storage strategy. If it is low, the shelf block 22 remote from the presses is used only for unprepared rolls, the shelf block 24 close to the presses is kept empty as much as possible, except for passing rolls through it. If the occupation of the depot is normal, the shelf block 22 remote from the presses is again used solely for unprepared rolls, the shelf block 23 close to the presses only for prepared rolls but the inner shelf block 24 is used as a buffer for unprepared and prepared rolls. The same process occurs when the occupation of the depot is high. What will be said below can be applied to the criteria "high", "normal" and "low".

The type of requirement is added as further criteria, wherein a differentiation is made between many small productions following each other and a few large ones. In the first case it is necessary to keep sufficient spaces clear for returns of already opened rolls from the roll changers 06 to the depot 06.

In the second case the priority lies in the path-optimized storage of unprepared and prepared rolls.

Further advantageous influential criteria for forming the storage strategy are represented by the time plan for stored fresh rolls in the depot 21. Here, a differentiation is made between the intended storage time periods during and outside of normal work times. In the first case the storage of fresh rolls preferably takes place (if the capacity is sufficient and the planned period of time until the intended use is not too long) via the preparation circuit 35 for preparation before they are taken to a shelf block 22 or 24. In the second case the rolls are stored unprepared (for example packaged and without glue preparation) and are only prepared later (during normal working hours).

The results of the partial strategies or criteria are now evaluated and the storage strategy is set. In variations only a partial number of the partial strategies can be used. If in the case of a more extensive depot 21 several inner shelf blocks 24 exist, the strategies should be correspondingly widened to cover shelf blocks which are "closer to the presses", "innermost" and well as "farthest away from the presses".

After setting the storage strategy, the issue of the storage request takes place, which is followed by the production preparation, taking into consideration the production planning and possibly preferred preparation times.

In a parallel process (removal process), material and return requests are registered by the press 01 (for example the roll changer 06) and checked to determine whether they can be met. If yes, the request is met. In an advantageous embodiment of the method, in case of a shortage it is provided to check the stock

for similar roll types (articles) on hand and, in case of a positive result, to provide the press 01 with them. Otherwise, for example, the immediate storage of a roll of matching type takes place, which in this case should be passed through as quickly as possible from the stock reception arrangement 18 via the preparation circuit 35, the inner shelf block 24, as well as the shelf block 23 close to the presses. In an advantageous embodiment the definition for the decision to be made in Fig. 4 regarding a "similar article" (roll) is stored in a table.

In the third parallel occurring process (redepositioning process), the depot occupation is continuously checked regarding the planned needs in such a way that the prepared and unprepared rolls of the various roll types are optimally positioned in regard to the production. This means that the rolls required at short order should as a rule already have been prepared and should at least be located in the inner or the outer shelf block 23 close to the presses. In this case, at short order should be understood to mean a minimum lead time, which lies a quarter hour (better yet, a half hour) ahead of the expected time the roll of material is required at the storage space 48. They should be located in the direct pickup area of the serving elements 30 close to the presses. The roll immediately required for the roll changer 06 should have already been delivered to a storage space 48 corresponding to the respective roll changer 06. The window of time for this should be at least 0 to 5 minutes prior to the call-up by the roll changer 06. In the depot area remote from the presses - for example in the pickup area of the serving element 29 remote from the presses, the preparation and storage of rolls required over a medium period of time takes place. For example, it is possible here to take unprepared rolls from the outer shelf

block 22 remote from the presses or the inner shelf block 24 and feed them to the preparation circuit 35 before they are then placed into intermediate storage in the inner shelf block 24 as prepared rolls. They are then accessible to the serving element 30 close to the presses and can be called up at short order. In accordance with the planned requirements, a production-oriented redepositioning of unprepared and prepared rolls in the depot 21 takes place in the third partial process. The determination of the redepositioning strategy is shown in greater detail in Fig. 6.

The redepositioning strategy ("useful production-oriented redepositioning" in Fig. 4) is determined in the partial process "redepositioning" in that initially the storage capacity is determined and a differentiation is made between low, normal and high storage occupations. As a function of this, in case of low occupancy the rolls are stored in a path-optimized way under the premise of minimal redepositioning, i.e. redepositioning should be avoided if possible. With normal occupancy, the rolls are stored path- and space-optimized, wherein needful redepositioning is permissible. With high occupancy, the rolls must be stored space-optimized, wherein redepositioning takes place in accordance with production requirements. Optimization in regard to path and/or space and/or the number of redepositioning processes can take place by means of mathematical algorithms, which search for states of a local or absolute minimum for the respective - possibly weighted variable(s) - while taking marginal conditions into consideration. This can take place while considering only the next step (for example movement of a single roll), but in an advantageous forward looking manner by considering several pending storing and/or removal processes, so that an optimized strategy as a whole is developed. In the ideal case the entire upcoming

production period is included in the determination of the strategy so that, even if individually observed redepositioning steps within a short period of time and considered by themselves (for example at the start) would not represent an optimal solution, the entire process as a whole results in an optimal run.

For example, "path-optimized" should be understood to mean that a roll suitable for a roll changer 06 and prepared is stored as closely as possible in the storage space 48 assigned to the latter - for example directly to the left or right of it. This pure form of a strategy is possible in a simple way with a low utilization or occupation of the depot 21, for example at least below 50%, in particular less than 40%.

With increasing utilization or occupation (normal), for example greater than 50%, a purely "path-oriented" strategy becomes increasingly difficult because of the large occupation. Still empty spaces are more and more occupied in a "space-oriented" manner, i.e. chaotically over the depot 21 in such a way, that increasingly more roll changers 06 must be supplied with a suitable roll via the center path. For example, the chaotically stored rolls are substantially distributed evenly over the length of the depot 21 which corresponds to the roll changers 06 in operation.

If the utilization or occupation becomes high, i.e. at least greater than 60%, the strategy of the storage (unprepared or prepared rolls) takes place in a "space-oriented" manner, i.e. the rolls are chaotically stored in the depot 21 over the length of the roll changers 06 which are operating and must be supplied. In the extreme case all storage spaces in the storage block 23 close to the presses, for example, are utilized.

The described partial processes (storage, removal and redepositioning processes) are preferably continuously iteratively performed. In this case it is basically also possible to let the processes run not side-by-side, but sequentially with continuous repetition.

The described depot 21 can be used in particular as a buffer storage 21 without the requirement of an upstream located storage facility, since unprepared, as well as prepared rolls of material are stored and managed in this depot 21. In that case the delivery, i.e. the storage of unprepared rolls of material, can take place, for example, directly from the stock reception arrangement 18 (from trucks, railroad cars, etc.). If in one variation a storage facility exclusively for unprepared rolls of materials is placed upstream, an output of material from this storage facility is understood to be a "stock reception arrangement" 18 in the above-mentioned sense. The bar code reader 53 at the indicated location can be omitted, since such information regarding the size and quality of the roll to be stored in the depot 21 can be taken from the information existing in the storage facility.

The criteria "high", "normal" and "low" and/or "many small", "a few large" (Figs. 5 and 6) can each be stored as concrete threshold values (changeable) functionally or in table form, on the one hand. However, as terms they can also be the basis of a fuzzy logic control. Depending on the total installation size of the presses and/or the depot, the definition of these criteria can be differently stored and therefore should be changeable. In an advantageous further development the system as a whole or in parts can also be embodied to be self-learning,

so that the boundaries between the different modi, or criteria, are displaced in specific areas by practical experience.

A total process for the storage of unprepared and prepared rolls of material for the web-fed rotary printing press now can be advantageously designed in such a way that production-relevant data regarding planned production runs (amount of paper, and/or type, and/or time) are transmitted directly from the production planning system 03, or via the press 01 to be supplied, by means of a signal connection to the computing and/or data processing unit 17, wherein in a first partial process the determination of a storage strategy and, depending on the requirements, a storage request for fresh, unprepared rolls of material takes place through the computing and/or data processing unit 17 on the basis of the transmitted usage data for the pending length of production time and the actual amount stored, as well as the determination of a production preparation time for unprepared rolls of material is made by the logic device implemented in the material supply system 05, taking into consideration a limited shelf life of the gluing preparation and the planned production time. In a second partial process, requests for rolls of material by the press 01 are directed to the material flow system via a signal connection, are registered in its computing and/or data processing unit 17 and are checked there on the basis of available data regarding the storage content for availability from the depot 21 and, in case of a positive result, an order in accordance with the request from the press 01 is forwarded directly via the material flow system 05 or via a depot administrative system for a transfer to a serving element 29, 30 of the depot 21. In a third partial process, on the basis of the transmitted production-relevant data regarding the planned requirements the storage status is checked by the

material flow system 05 in such a way that the prepared and unprepared rolls of material of the required types of rolls are positioned in a production-optimized way wherein, in accordance with the planned requirements, a strategy for the production-oriented shifting of unprepared and prepared rolls within the depot 21 is determined and executed.

List of Reference Symbols

01	Machine, printing press
02	Material supply system, roll supply system
03	Production planning system
04	Printing unit, printing tower, unit
05	Control system, material flow system
06	Roll changer, unit
07	Unit, folding apparatus
08	Operating and computing unit
09	Signal line, network, internal to the printing press
10	-
11	Management level, press management level
12	Signal connection
13	Computing and/or data processing unit, server
14	-
15	Signal connection
16	Signal connection
17	Computing and/or data processing unit
18	Subsystem, stock reception
19	Subsystem, first transport system
20	-
21	Depot
22	Shelf block, outer
23	Shelf block, outer
24	Shelf block, inner
25	-
26	Storage space

27	Storage space
28	Storage space
29	Serving element, shelf serving element
30	Serving element, shelf serving element
31	Transport track
32	Storage space, transfer station
33	Transport track
34	Storage space, transfer station
35	Preparation circuit
36	Transport track
37	Unpacking station
38	Glue preparation station
39	Storage space, transfer station
40	-
41	Transport track
42	Storage space, transfer station
43	Transport track
44	Storage space, transfer station
45	-
46	Transport system
47	Transport system, inner supply circuit
48	Storage space, supply space
49	-
50	-
51	Gripping and/or lifting mechanism
52	Support
53	Bar code reader
A	Section
B	Section